

**Original Research Paper**

## Taxonomic revision of the cultivated species of *Mimusops* (Sapotaceae) in Egypt, with new records

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### ABSTRACT

During the process of updating horticultural records of this genus in Egypt, five problems were identified: lack of publications, lack of clarity between species, numerous errors of identifications, loss of earlier documented records of identity, as well as, the introduction and cultivation of new plants during the 19<sup>th</sup> Century added to the complexity of the problem. In this study, the taxonomic aspects of genus *Mimusops*, were thoroughly studied to identify the most reliable characters for taxon delimitation. Our assessment was based on morphological characters representing habit, leaves, petioles, flowering pedicels, buds, floral parts, fruit and seed. Fieldwork have revealed the presence of four species, of which *Mimusops kummel* and *M. zeyheri* are new records. The latter species is represented in Egypt by *M. zeyheri* var. *laurifolia*. This variety has been neglected by many authors. Additionally, *Mimusops elengi* L. was believed to be cultivated in Egypt, but no materials have been encountered that could confirm it. The specimens earlier identified as *M. elengi* actually belong either to *M. kummel* or to *M. laurifolia*. A detailed description of the genus and species with photographs, an identification key, and synonymy for each taxon are provided.

**Keywords** : Cultivated - species, new records, *Mimusops*, Sapotoideae, Sapoteae, Taxonomy

### INTRODUCTION

Sapotaceae Juss. (1789) is a well-marked family characterized by its well-developed system of latex; two-armed, unicellular trichomes; often coppery leaves beneath; axillary, ramiflorous or cauliflorous inflorescence; simple or complex flower structure; oppositipetalous stamens; and sometimes with staminodes. It is a woody tropical and subtropical family, and is represented by 59 genera with 1250 species, of worldwide distribution. [Pennington, 1991; Govaerts *et al.*, 2001; Swenson *et al.*, 2007; Gautier *et al.* 2013]. *Sapotaceae* is a member of *Ericales* (APG III, 2009), sister to *Ebenaceae* and *Primulaceae* (Rose *et al.* 2018).

Recent molecular analyses (Swenson & Anderberg, 2005; Smedmark *et al.*, 2006), place *Mimusops* L. in the tribe *Sapoteae* (=Mimusoepae sensu Pennington, 1991) of subfamily *Sapotoideae*; while *Sapoteae* s.str. only includes subtribe *Mimusopinae* and *Manilkarinae* (with the exception of *Northia*) proposed earlier by Pennington (1991). Moreover, *Sapoteae* has been

circumscribed as monophyletic, with the monophyletic *Mimusops* (Smedmark *et al.*, 2006, Gautier *et al.*, 2013). *Mimusops* is a palaeotropical genus (with exception of *M. elengi* in Australia), with 47 species (Govaerts *et al.*, 2001). Members of *Mimusops* are unarmed trees and shrubs, and diagnosed by minute caducous stipules; complex flower structure with biseriate calyx of 4 sepals each; corolla-lobes 8, always 3-segmented (one erect median clasping the opposing stamen and two laterals attached dorsally); stamens 8, in one whorl; staminodes 8, well developed, alternating with the stamens, hairy, inflexed and often forming a sheath round the gynoecium; ovary 8-loculed; fruit 1-6-seeded; seeds generally with shiny brown testa, and with a small, basal to basi-ventral seed-scar. In ancient Egypt, *Mimusops laurifolia* was considered as a sacred tree. The twigs were used at funerals and have been found in the Egyptian tombs with mummies. In the tomb of Djoser (3<sup>rd</sup> Dynasty, Saqqara), the fruits of *Persea* were deposited as offerings; while in the tomb of Tutankhamun (18<sup>th</sup> Dynasty, Luxor), the leaves and twigs were used in making funerary garlands and floral



bouquets (Täckholm, 1951; Darby *et al.*, 1977; Friis 1981).

For Egypt, a relatively few short accounts of *Mimusops* have been published (Bircher, 1960; Diwan *et al.*, 2004; Hamdy *et al.*, 2007; Youssef *et al.*, 2012; Youssef & Hamdy, 2013; Gamal, 2018). Table (1) summarizes the available information about the genus in Egypt. It is clear that different authors have treated differently the cultivated species. This has led to a considerable confusion in species identifications. The introduction and cultivation of new plants in Egypt during 19<sup>th</sup> Century has added to the complexity of this problem.

Schweinfurth (1883) recorded one species: *Mimusops schimperi* Hoscht. ex A. Rich. [currently treated as *M. laurifolia* (Forssk.)Friis] from Egyptian tombs. He identified the evergreen folded leaves frequently found with Egyptian mummies. Later, *M. laurifolia* has appeared regularly in the Egyptian texts. Delchevalerie (1899) and Sickenberger (1901) reported the occurrence of *M. elengi* L. in the gardens of El Rhodah and Cairo respectively. This has been followed by later investigators and has appeared regularly in the Egyptian literature (Bircher, 1960; Diwan *et al.* 2004; Hamdy *et al.* 2007; Hamdy, 2010; Youssef & Hamdy, 2013). In the study of the Gardens of the Hesperides, Bircher (1960) cultivated eleven species of *Mimusops* s.l. in Al-Saff Garden. This includes

species with 3-merous flowers (now included in Manilkarinae); while only three are conspecific to *Mimusops*. These are: *M. elengi*, *M. caffra* (a new addition), and *M. laurifolia* (= *M. schimperi*). She stated that all the species were cultivated in her garden. Today, Al-Saff Garden has been vanished due to urbanization and land degradation. Recently in Diwan *et al.* (2004), the number of species had been reverted to only two (*M. caffra* and *M. elengi*) with short notes in arabic. Hamdy *et al.* (2007) listed the plant distribution of three species in three historic gardens in Egypt (Zohriya, Orman, and Zoo). They reported *Mimusops elengi*, *M. laurifolia*, and *M. caffra* in Orman; *M. elengi* and *M. laurifolia* in Zohriya; and *M. laurifolia* in the Zoological Garden. Hamdy (2010) reported three species in Aswan, of which *Mimusops kummel* Bruce ex A.DC. had been added. However, *M. kummel* sensu Hamdy was actually *M. laurifolia*. Both of Youssef *et al.* (2012) and Youssef & Hamdy (2013) listed three species which were previously recorded; while Gamal (2018) only recorded *M. laurifolia*.

The aim of the present study is to update the list of the cultivated species of the genus *Mimusops* in Egypt; to provide an identification key for these species; to study thoroughly the taxonomic parameters for taxon delimitation; and to give a detailed description with photographs, and synonyms for each taxon. These data are presented for the first time.

**Table 1 : Historical review of *Mimusops* species cultivated in Egypt. (+=present, -=absent, ×=present but cited under a synonym, \*= a new record).**

Taxa	Schweinfurth (1883)	Delchevalerie (1899)	Sickenberger (1901)	Täckholm (1951)	Bircher (1960)	Diwan <i>et al.</i> (2004)	Hamdy <i>et al.</i> (2007)	Hamdy (2010)	Youssef <i>et al.</i> (2012)	Youssef & Hamdy (2013)	Gamal (2018)	Present study (2020)
<i>M. elengi</i> L.	-	+	+	-	+	+	+	+	+	+	-	-
<i>M. caffra</i> E. Mey. ex A.DC.	-	-	-	-	+	+	+	+	+	+	-	+
<i>M. kummel</i> Bruce ex A.DC.	-	-	-	-	-	-	-	-	-	-	-	*
<i>M. laurifolia</i> (Forssk.)Friis	×	-	-	×	×	-	+	×	+	+	+	+
<i>M. zeyheri</i> Sond. var. <i>laurifolia</i> Engl.	-	-	-	-	-	-	-	-	-	-	-	*
	1	1	1	1	3	2	3	3	3	3	1	4

## MATERIALS AND METHODS

In this study, morphological data were scored from examination of Egyptian herbarium specimens, digital photographs of the authentic material kept in BM, BR, C, FT, K and LG; examination of fresh material collected during conducted investigations; and the contribution sources of Heine (1963), Meeuse (1963), Hemsley (1968), Friis (1981, 2003, 2006), Kupicha (1983), Pennington (1991) and Govaerts *et al.* (2001).

The herbarium study was based on the examination of specimens kept in the major Egyptian herbaria (CAI, CAIM, MAZHAR, Orman, and Aswan) [acronyms follow Holmgren *et al.*, 1990].

Living material included those collected during investigations in different botanical garden of Cairo [Egyptian Museum, El-Nahr and El-Zohriya]; Giza [National Gene Bank (NGB), Mazhar, Orman, and the Zoological gardens]; and Aswan [Plant Island]. These investigations were performed to obtain fresh material for the *in vivo* study of the vegetative, floral, and fruit characters; for preparing exsiccate; and to make field observation in several localities. Voucher specimens have been deposited in the Cairo University Herbarium (CAI). The examined representative specimens were geographically arranged according to the phytogeographical territories of Egypt proposed by El Hadidi (2000: 14-22). Localities and collectors are given in Appendix 1.

For each species, nomenclature, authentic type specimens and synonyms are given with photographs of fresh material, as well as, phenology using the information from herbarium labels and investigations. Type and authentic material seen by the authors are followed by (!). Citation of the authors follows Brummitt and Powel (1992).

## RESULTS AND DISCUSSION

### I. The genus *Mimusops* L. in Egypt

The present work resulted in a total number of four cultivated species, of which *Mimusops kummel* Bruce ex A.DC. and *M. zeyheri* Sond. are new additions. Today, both are only cultivated in El-Zohriya Garden. This is attributed to the introduction and cultivation of new plants in our Egyptian gardens. *Mimusops zeyheri* is a polymorphic taxon, in which two varieties are currently accepted: var. *zeyheri* and var. *laurifolia* Engl. (Engler, 1904). The relationship of staminode length to its stamens and corolla lobes was

successfully employed for the authors to recognize *M. zeyheri* var. *laurifolia* Engl. in Egypt. All herbarium specimens, identified by earlier investigators as *M. elengi* have been re-identified either as *M. laurifolia* or as *M. kummel*. Therefore, the occurrence of *M. elengi* in Egypt has not been supported by this research.

### II. Taxonomy

*Mimusops* L., Sp. Pl., ed., 1: 349 (1753) - Gen. Pl., ed.5, 165 (1754).

#### Synonyms:

*Elengi* Adans., Fam. Pl.2: 166 (1763).

*Binectaria* Forssk., Fl. Aegypt.-Arab. 82 (1775).  
Type: *B. laurifolia* Forssk.

*Phlebolithis* Gaertn., Fruct. Sem. Pl. 1:201 (1788).  
Type: *P. indica* Gaertn.

*Imbricaria* Comm. ex Juss., Gen. Pl. 152 (1789).  
Type: *I. barbonica* J.F.Gmel.

*Radia* Noronha, Verh. Batav. Genootsch. Kunsten 5(4):3 (1790). "nom. nud.

*Mimusops* sect. *Quaternaria* A.DC.in DC., Prodr. 8: 202 (1844).

*Mimusops* sect. *Imbricaria* (Comm. ex Juss.) Hartog, J. Bot.17: 358 (1879).

*Semicipium* Pierre, Not. Bot. 10 (1890).  
Type: *S. boivinii* Hartog ex Pierre.

*Kaukenia* Kuntze, Revis. Gen. Pl. 2:406 (1891).

*Mimusops* subgenus *Imbricaria* (Comm. ex Juss.) Engl. in Engl. & Prantl, Nat. Pflanzenfam. 4(1):142 (1891).

**Description** : Unarmed trees or shrubs, with abundant to scarce milky latex. **Young vegetative parts** commonly adpressed-pubescent with ferruginous, brownish, cinereous or yellowish indumentum, later glabrous or glabrescent. **Leaves** thinly to firmly coriaceous, simple, alternate or spirally arranged, clustered at the end of branches or not, with brochidodromous venation, and with  $\pm$  thickened paler margin; petiolate or sessile; stipules minute and caducous. **Flowers** bisexual actinomorphic, 1-4(-8), borne in the axils of persistent or fallen leaves, sometimes on brachyblasts (short, stout spur shoots), pedicelled; pedicel shorter to longer than the petiole, not or slightly accrescent in fruit, adpressed-pubescent. **Calyx** of 8 sepals; sepals in two dissimilar whorls of

4, free or slightly connate at base, persistent, not or slightly accrescent in fruit, hairy on both surfaces but less internally; outer sepals valvate; inner narrower, and paler in colour. **Corolla** gamopetalous, white, cream, yellowish, brownish or pink, frequently as long as calyx or slightly longer, rarely shorter; corolla-tube frequently much shorter than the lobes; corolla-lobes 8, 3-segmented; median segment entire, erect and clasping the stamen, sometimes incurved against the gynoecium; the two lateral segments shorter to longer than the median segment, entire (undivided) or further divided. **Stamens** 8, opposite to the corolla lobes, in one whorl, inserted at the top of the corolla-tube and adnate to it; anthers relatively large, extrorse, apiculate, frequently hairy and longer than the filaments; filaments free or partly fused with the staminodes; **staminodes** 8, well developed, alternate with the stamens, simple, with entire or dentate apex, commonly inflexed and connivent to form a conical sheath concealing the gynoecium, densely pilose dorsally and along margins. **Ovary** ovoid to globose or cylindrical, hairy, 8-loculed; locules uniovulate; style slender, exerted from the floral parts or not, glabrous or with few scattered hairs. **Fruit** indehiscent, baccate, fleshy to rather leathery, ovoid to ellipsoid or globose, with persistent calyx at the base and remnants of the style at the apex, 1-6-seeded; **seeds** laterally compressed, with hard and shining testa; attachment scar small, basal or basi-ventral, circular or ellipsoid; embryo with copious endosperm, and thin foliaceous cotyledons.

A paleotropical genus, with the exception of *M. elengi* in Australia. It comprises 47 species, with 25 species in Africa; 15 in Madagascar and the Comoros; 3 in the Mascarenes; one in Seychelles; and 3 in the Indo-Pacific (one in Asia through Malesia to the Pacific, one in Andamans Islands, and one in Sri-Lanka) [Govaerts *et al.*, 2001].

**Key to *Mimusops* species cultivated in Egypt:**

- 1a. Leaves firmly coriaceous, obcordate, cuneiform or obovate, 2-7 cm long, lateral veins 5-8 pairs, margin revolute; petiole 0.5 - 1cm long; bole twisted, seldom straight.....**1. *M. caffra***
- b. Leaves coriaceous to thinly coriaceous, may be obovate, never obcordate or cuneiform, (4 -) 7-14.5 cm long, lateral veins 10–25 pairs, margin unrevolute; petiole 1 –5 cm long; bole straight 2

- 2a. Flowering pedicels (1.5–) 2–4 cm long, longer than petiole; flower buds 7–10 mm long, 2.0–2.5 times as long as broad, acute; calyx 10 –12 mm long; corolla 9 –12 mm long; stamens 5 –6 mm long; gynoecium 12–15 mm long; style 10–12 mm long, distinctly exerted; leaves at least 5 times as long as the petiole, lateral veins 15 –25 pairs..... **2. *M. Kummel***
- b. Flowering pedicels 1.0–2.0 cm long, shorter than petiole; flower buds 3–7 mm long, 1–2 times as long as broad, blunt to rounded or acute; calyx 5–10 mm long; corolla 6–9 mm long; stamens 2–5 mm long; gynoecium 4–11 mm long; style 2–9 mm long, included or slightly exerted; leaves up to 5 times as long as the petiole, lateral veins 10–15 pairs.....**3**
- 3a. Leaves clustered at the end of branches; flower buds blunt or rounded, 3-5×3-4 mm, 1.00–1.25 times as long as broad; corolla-tube 4 mm long, longer than corolla-segments; lateral segments irregularly incised; stamens c.2 mm long; gynoecium 4-5 mm long; style 2-3 mm long, included, hairy below; fruiting calyx reflexed; fruit green when ripe, 1-4 seeded; seed scar basi ventral, circular; bole buttressed.....**3. *M. laurifolia***
- b. Leaves not clustered; flower buds acute, 5–7 × 3–5 mm, 1.5–2 times as long as broad; corolla-tube 1–2 mm long, shorter than corolla-segments; lateral segments entire; stamens 4 –5 mm long; gynoecium 7–11 mm long; style 5–9 mm long, included or slightly exerted, glabrous; fruiting calyx clasped to the fruit or spreading; fruit brittle yellow or orange when ripe, 1–seeded; seed scar basal, oblate; bole not buttressed...**4. *M. zeyheri***

**1. *Mimusops caffra*** E. Mey. ex A. DC. in DC., Prodr.8: 203 (1844) “Coast red milkwood”

Type: Southern Africa (Eastern region): Pondoland or Natal. Between Umtentu and Um Zimkulu Rivers, 1837, *Drège J.F. s.n.*, K000435321, isotype, (K-image!).

**Homotypic synonym:**

≡ *Kaukenia caffra* (E. Mey. ex A.DC.) Kuntze, Revis. Gen. Pl. 2:406 (1891).

**Heterotypic synonym:**

=*Mimusops revoluta* Hochst. apud Krauss, Flora 27: 825 (1844). Type: Southern Africa: Port NATAL. In woods on the dunes near Durban, 1840, Krauss F. 76, K000435320, isotype, (K-image!).

**Description:** Much branched, shrub or small- to medium-sized tree, up to 15 m high, with milky latex, and rounded crown; bark dark grey, rough, shallowly and longitudinally fissured, wrinkled; bole seldom straight, often twisted, and not buttressed. **Young vegetative parts** densely adpressed-pubescent, with yellowish-brown to ferruginous indumentum, soon glabrescent. **Leaves** firmly coriaceous, not clustered, petiolated; blade obovate, obcordate or cuneiform, 2.0–7.0 cm long, 1.0–4.0 cm wide, 2–2.5 times as long as broad; apex retuse, emarginated or rounded; base acute; margin yellowish, thickened, and revolute; upper surface glaucous, glossy, with yellowish-brown to ferruginous hairs when young, soon glabrous; lower surface pale green, mat, adpressed-pubescent, with persistent fulvous indumentum along the midrib; midrib prominent below and flush above on both surfaces; lateral veins 5– 8 pairs; petiole canaliculate towards the leaf base on upper surface, dilated at the base, 0.5–1.0 cm long, shorter than the leaf blade (leaf blade = 5– 15 x petiole), adpressed-pubescent, with ferruginous indumentum. **Inflorescence** (1–) 2–3(–4)–flowered; flower 10–20 mm in diam.; flower buds 8–10×3–5 mm, 2–3 times as long as broad, acute, pedicelled; pedicel erect to ascending or commonly deflexed, dilated at apex, 20–30 mm long, not accrescent in fruit, sulcate when dry, longer than the petiole (pedicel= 3–4 × petiole), densely adpressed-pubescent, with fulvous indumentum. **Calyx** 8–10 mm long; calyx-tube c. 1.0 mm long; outer calyx lobes lanceolate, 8–9×2–3 mm, with a dorsal midvein ceases below the acute apex, and with 1–2 lateral veins along the midvein on each side, densely adpressed-pubescent with fulvous indumentum outside and inside (less inside); inner calyx-lobes shorter, paler, and narrower, deltoid lanceolate, 7–8×1 mm, with a prominent, dark brown, median dorsal groove, and with fulvous hairs. **Corolla** white or cream, as long as the calyx; corolla-tube 1–2 mm long; median segment lanceolate, 8–9 × 0.5–1.0 mm, pluri-nerved, with acute apex and involute margins;

lateral segments 6–7 mm long, slightly shorter than the median segments, each shallowly to deeply divided into two narrowly deltoid lacinae. **Stamens** 5–6 mm long; filaments subulate, 2.0–2.5 mm long, hairy at base; anthers lanceolate, 3–4×1 mm, apiculate (apicula c. 0.5 mm long), hairy on and along the connective tissue; staminodes deltoid-lanceolate, 3–4 mm, shorter than the stamens and corolla-segments, acute, densely pilose outside (especially along the margins). **Gynoecium** 9–11 mm long; ovary ovoid to globose, with black brown colour at apex and base, 1.5–2.0 x 1.0–1.5 mm, pilose; style black or reddish-brown, slender, 7–9 mm long, as long as corolla or slightly exerted, sparsely hairy below; stigma c. 0.2 mm wide, hairy. Fruiting calyx clasped to the fruit; **fruit** orange-red or red when ripe, globose or subglobose to ovoid, 2.0–2.5 x 1.5–2 cm, 1.0–1.5 times as long as broad, with rotundate or shortly rostrate apex (beaked/pointed tip), usually crowned by the persistent style at least when young, 1-seeded, ovoid to ellipsoid, 10–15 x 7–9 x 5–7 mm, glabrous; testa brown, shiny, with basal ellipsoid seed scar. (Fig.1)

**Phenology:** Flowering season May-July.

**Global distribution:** Native to the coastal scrub of Southern Africa (Cape Province to Natal) northwards to Mozambique in South Tropical Africa.

**Taxonomic note:** Unfortunately, our specimens are without fruits. Therefore, characters of the fruit and seed are derived from authentic specimens and from literature of Meeuse (1963), Baehni (1965), and Kupicha (1983).

**Uses:** As ornamental tree.

2. *Mimusops kummel* Bruce ex A.DC. in DC., Prodr. 8: 203 (1844) “Red milkwood”

Type: Northeast Tropical Africa: Ethiopia. Tigre. In faucibus montium et ad declivia septentrionalia Montis Scholoda, 20 June -31 December 1837, Schimper G.H.W. 280, K000435270, lectotype by Hemsley, 1968 (K, image!).

**Homotypic synonym:**

≡ *Kaukenia kummel* (Bruce ex A.DC.) Kuntze, Revis. Gen. Pl. 2: 40 (1891).

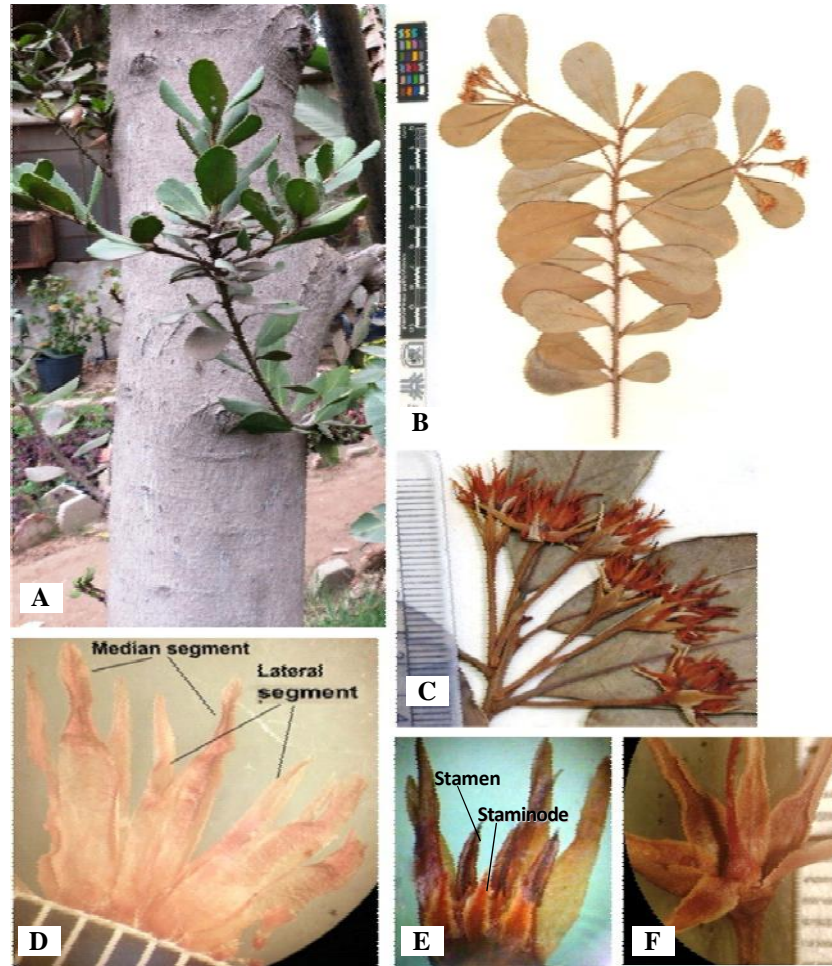


Fig. 1 : Field photographs of *Mimusops caffra* E. Mey. ex A. DC.

A: Trunk; B: Twig with leaves and inflorescences; C: Inflorescence; D: Corolla longitudinally sectioned and opened, ventral view; E: Corolla opened with 3 corolla-lobes, showing median and 2 lateral segments; F: Corolla and one sepal removed, showing gynoecium [Aswan Botanic Garden (Plant Island); *Abdelmohsen* s.n. (CAI)].

### Heterotypic synonyms:

= *Imbricaria fragrans* Baker in Oliv., Fl. Trop. Afr. 3: 509 (1877). Type: West Tropical Africa: South Nigeria. Yoruba, s.d., *Barter* C. 1217: K000435260, holotype (K, image!).

= *Mimusops fragrans* (Baker) Engl. in Engl. & Prantl, Nat. Pflanzenfam. 4(1): 152, fig. 82 N-S (1891).

= *Binectaria fragrans* (Baker) Kuntze, Revis. Gen. Pl. 2: 406 (1891).

= *Mimusops djurensis* Engl., Monogr. Afr. Pflanzenfam. 8: 75, tab. 30/B (1904). Type: Northeast Tropical Africa: Sudan. Seriba Ghattas, im lande der Djur Reise nach central Africa & Sudan, 11 April 1869, *Schweinfurth* G. 1379, K000435271 &

*Schweinfurth* G. 2428, K000435273, isosyntypes, (K, images!).

= *Mimusops langenburgiana* Engl., Monogr. Afr. Pflanzenfam. 8: 70, tab. 28/D (1904). Type: East Tropical Africa: Tanzania. Rungwe District, near Tukuya [Langenburg], s.d., *Goetze* S.G.864, BR0000006282295, isotype, (BR, image!).

= *Mimusops stenosepala* Chiov., Atti Reale Accad. Italia, Mem. Cl. Sci. Fis. 11: 47 (1940). Type: Northeast Tropical Africa: Ethiopia. Neghelli, poscoli, 16 March 1937, *Senni* L. 1015, FT 002542, holotype (FT, image!).

**Description:** Small-to large-sized evergreen tree, up to 25 m high, with milky latex; crown much branched; bark dark grey, longitudinally fissured and wrinkled;

bole straight, not buttressed. **Young vegetative parts** densely adpressed-pubescent, with ferruginous hairs, soon glabrescent. **Leaves** coriaceous, not clustered, broadest part at the middle or above and petiolated; blade elliptic to oblong-elliptic, ovate-oblong or obovate (5.0-)7.0-14.5 cm long, 2.0-5.0 cm wide, 2-4 times as long as broad; apex frequently acuminate to cuspidate or acute, rarely emarginated or obtuse; base acute or cuneate; margin entire; upper surface dark green, glossy, densely adpressed-pubescent, with ferruginous indumentum, later glabrous; lower surface paler, mat, with persistent ferruginous hairs along the midrib; midrib prominent on both surfaces; lateral veins 15-25 pairs; vein reticulation obscure above, obscure or slightly raised beneath; petiole canaliculate, sulcate when dry, 0.5-2.0(-2.5) cm long, much shorter than the leaf blade [blade = 5-9 × petiole], densely adpressed-pubescent, with ferruginous indumentum. **Inflorescence** (1 -)2-4-flowered; flowers 10 -13 mm in diam.; flower buds 7-10 × 4-5 mm, 2-2.5 times as long as broad, acute, pedicelled; pedicel erect to ascending, or commonly recurved, slender, (15 -) 20-40 (-50, not in ours) mm long, longer than the petiole [pedicel= (1.5-) 2-3×petiole], densely adpressed-pubescent, with ferruginous hairs. **Calyx** 10-12 mm long; calyx-tube c. 1 mm long; outer calyx-lobes lanceolate, 10-11 × 2-3 mm, with acute apex, paler margin, and densely pubescent with ferruginous hairs on both surfaces (less hairy inside especially at the darker base); inner calyx-lobes slightly shorter and narrower, 9 -10 × 1-2 mm, acute, with brown dorsal groove, with paler hairs. **Corolla** white or cream, 9-12 mm long, as long as calyx or slightly shorter; corolla-tube 1-2 mm long; median segment oblong-elliptic or lanceolate, 9-10×2.0 mm, with 2-3 pairs of prominent lateral veins along the prominent midvein, apex acute to obtuse; lateral segments 8-10 mm long, as long as the median segments or slightly shorter, entire or often divided into 2 -3 lanceolate-linear laciniae. **Stamens** 5-6 mm long; filaments reddish-brown, 2.0-3.5 mm long; anthers lanceolate, 2.5-4.0 × 1.0-1.5 mm, hardly longer than filaments, with an apiculate apex (apicula 0.3-0.5 mm long), hairy on and along the connective tissue; staminodes deltoid lanceolate or lanceolate-linear, 4-6(-7) mm long, gradually or abruptly narrowed above into an acute apex with an extended, paler and glabrous tip (1-2 mm long), frequently as long as the stamens or shorter, rarely slightly longer, shorter than the corolla-segments, externally densely pilose throughout except

the extended apex. **Gynoecium** 12-15 mm long; ovary ovoid, 2-3 × 1-2 mm, densely covered with ferruginous hairs; style reddish-brown, slender, 10-12 mm long, distinctly exerted, glabrous; stigma 0.2-0.3 mm wide, hairy. Fruiting calyx clasped to the fruit; **fruit** yellowish-orange or orange-red, ellipsoid to ovoid, 2.0 -2.5 × 1.0-1.5 cm, 2.0-2.5 times as long as broad, with acute to obtuse or commonly with shortly rostrate/beaked apex, usually crowned by the persistent style at least when young, glabrous, 1-seeded; **seed** ellipsoid, laterally compressed, 18-20 × 9 × 7 mm; testa brown, shiny, with basi-ventral scar; scar ellipsoid, c. 3.5 × 2 mm, (Fig. 2).

**Phenology:** Flowering season May-July, October; Fruiting season: January, June, October.

**Global distribution:** It is widely distributed in Tropical Africa. It occurs in West and West-Central Africa (Ghana, Guinea, Ivory Coast, Nigeria, Togo, Central Africa, and Cameroon); Northeast Africa (Ethiopia, Somalia, and Sudan), East Africa (Kenya, Tanzania, and Uganda), and Malawi in South Tropical Africa.

**Taxonomic notes:** It is unique by its entire or divided lateral segments with lanceolate-linear laciniae, as well as the anthers hardly longer than filaments. In all our cultivated specimens, the staminodes are 4 -6(-7) mm long, frequently as long as stamens or shorter, rarely slightly longer.

**Hamdy et al. (2010)** reported the occurrence of *Mimusops kummel* from Aswan, but it was actually belong to *M. laurifolia* (Forssk.) Friis.

In Zohriya garden, the tree was initially mistaken for *M. elengi* L. Both species are within the same range of leaves (shape, size, apex, lateral veins, and petiole). However, indumentum colour, floral and fruit characters are diagnostic to distinguish both. In *Mimusops kummel*, the indumentum is with ferruginous hairs [vs. rufous hairs] along the midrib beneath, narrower (10-13 mm wide) flowers [vs. 15-20 mm wide]; longer (10-12 mm long) calyx [vs. 7-9 mm long]; shorter (1-2 mm long) corolla-tube [vs. 2-4 mm long]; entire or divided lateral segments [vs. entire]; longer (10-12 mm long) style [vs. 3-5 mm long]; narrower (1.0-1.5 mm wide) fruit [vs. 1.5-2.5 mm wide], and with an ellipsoid seed scar [vs. circular].

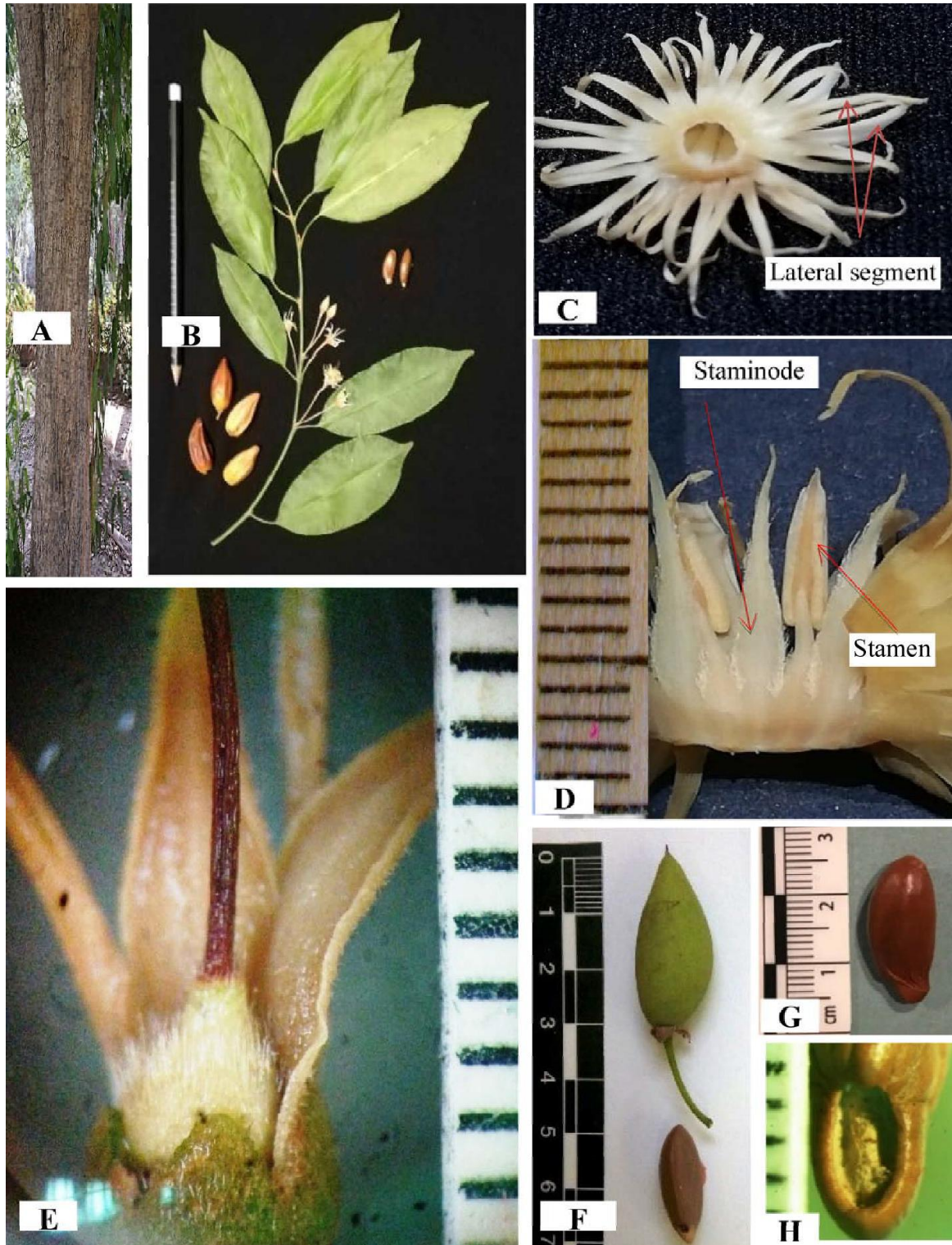


Fig. 2 : Field photographs of *Mimusops kummel* Bruce ex A. DC.

A: Trunk; B: Twig with leaves, inflorescences, fruits, and seeds; C: Lateral segments with its entire or divided laciniae, viewed from below; D: Corolla opened with stamens and staminodes, dorsal view; E: Corolla and most sepals removed showing gynoecium; F: Fruit (above) and seed (below); G: Seed, lateral view; H: Seed with seed-scar, ventral view [Zohriya Garden; *Abdelmohsen* s.n. (CAI)].



**Uses:** As ornamental tree

**3. *Mimusops laurifolia*** (Forssk.) Friis, Kew Bull. 35(4): 787, figs. 1-3 (1981) “*Persea*”

Type: Arabian Peninsula: Yemen. Bayt al Faqih “Beit el Fakih”, 1763, *Forsskål P.* 359, C10001840 and *Forsskål P.* 360, C10001841, syntypes (C, images!).

**Homotypic basionym:**

≡ *Binectaria laurifolia* Forssk., Fl. Aegypt.-Arab.: CX No. 252,82, Cent III No. 54 (1775).

**Heterotypic synonyms:**

= *M. Kauki* Vahl, Symb. Bot. 1:27 (1790) [non L., 1753].

= *M. schimperi* Hochst. ex A. Rich., Tent. Fl. Abyss. 2:22 (1851). Type: Northeast Tropical Africa: Ethiopia. Tacazze; infra Dscheladscheranne, 09 December 1839, *Schimper W.G.* 697, LG0000090026638 (LG, image!), Isosyntype; Tigre; “Inter Dscheladscheranne et Selassaquilla”, in convalle fluvii Tacazze, 01 May 1840, *Schimper W.G.* 873, K000435265, syntype (K, image!).

= *Mimusops kummel* sensu Hamdy, Gard. Hist. 38 (2): 276 (2010) [non Bruce ex A. DC., 1844].

**Description:** Small-to medium-sized, evergreen tree, up to 15 m high, with milky latex; crown rounded; bark brown, longitudinally fissured and wrinkled; bole straight and buttressed. **Young vegetative parts** densely adpressed-pubescent, with ferruginous indumentum, later glabrescent. **Leaves** subcoriaceous, densely clustered at the end of branches or on spurs (c. 2.0–3.0 cm long) if present (not in ours), broadest part at the middle or below and petiolated; blade elliptic to oblong-elliptic or lanceolate, 4.0–12.0 cm long, 2.0–5.0 cm wide, leaf blade 2–3 times as long as broad; apex acute or bluntly apiculate, rarely emarginate; base cuneate or obtuse; margin yellow, entire; upper surface dark green, glossy, densely adpressed-pubescent with ferruginous hairs, later glabrous; lower surface paler, mat, with persistent ferruginous hairs on and along the midrib; midrib prominent below and flush above on both surfaces; lateral veins 10–15 pairs; petiole pale in colour, canaliculated towards the leaf base on upper surface, sulcate when dry, 2.0–5.0 cm long, shorter than the leaf blade [blade = 2–4×petiole], adpressed-pubescent,

with ferruginous indumentum. **Inflorescence** (1–)2–4-flowered; flowers 10–12 mm in diam.; flower buds 3.0–5.0 × 3.0–4.0 mm, 1.0–1.25 times as long as broad, with blunt or rounded apex, pedicelled; pedicel erect to patent, 10–20 mm long, accrescent in fruit (up to 2.5 cm long), shorter than the petiole (petiole = 2–3× pedicel), adpressed-pubescent with ferruginous hairs. **Calyx** 5.0–7.0 mm long; calyx tube c. 1.0 mm long; outer calyx-lobes green, lanceolate, 5.0–6.0 × 2.0–3.0 mm, with obtuse apex, and with white or paler stripe along the margin, adpressed-pubescent, with ferruginous hairs on both surfaces (less hairy inside); inner calyx-lobes paler, narrower, oblong-lanceolate, 4.0–5.0 × 2.0 mm, as long as or slightly shorter than the outer ones, dorsally with a distinct green median groove ceases below the ± mucronulate apex, hairy on both surfaces (less hairy inside). **Corolla** yellowish-white, 6.0–7.0 mm long, as long as the calyx or slightly longer; corolla-tube c.4 mm long, slightly longer than the corolla lobes; median segment narrowly spatulate or spatulate-oblong, 2.0–3.0 × 0.5–1.0 mm, with descending lateral veins along the midvein which ceases below the ± acute apex, and with uneven margin above; lateral segments c.3.0 mm long, as long as the median segments or slightly longer, each irregularly divided (incised) into narrowly oblong-lanceolate to linear laciniae. **Stamens** c. 2.0 mm long; filaments subulate, c. 0.5 mm long; anthers lanceolate, c. 2.0 × 1.0 mm, apiculate (apicula c. 0.2 mm long), hairy; staminode lanceolate-linear, c. 2.5 mm long, slightly longer than stamens, slightly shorter than the corolla-lobes or subequal, densely hairy throughout. **Gynoecium** 4.0–5.0 mm long; ovary globose or subglobose, ribbed, c.2.0 mm wide, hairy (more along ribs); style reddish, ± slender, included, 2.0–3.0 mm long, hairy below and glabrous above; stigma reddish, c. 0.3 mm wide, hairy. Fruiting calyx reflexed; **fruit** green, ovoid to ellipsoid, 3.0–4.0 × 2.0–2.5 cm, with acute or commonly with shortly rostrate (beaked) apex, glabrous, 1–4-seeded, 1.5–2 times as long as broad; **seeds** ellipsoid, laterally compressed, 17–20 × 10–12 × 10 mm; testa pale (toffee) or dark brown, shiny; scar small, basi-ventral, circular, 2.0–3.0 mm in diam, (Fig. 3).

**Phenology:** Flowering season: March-June, October; Fruiting season: June-August, October.

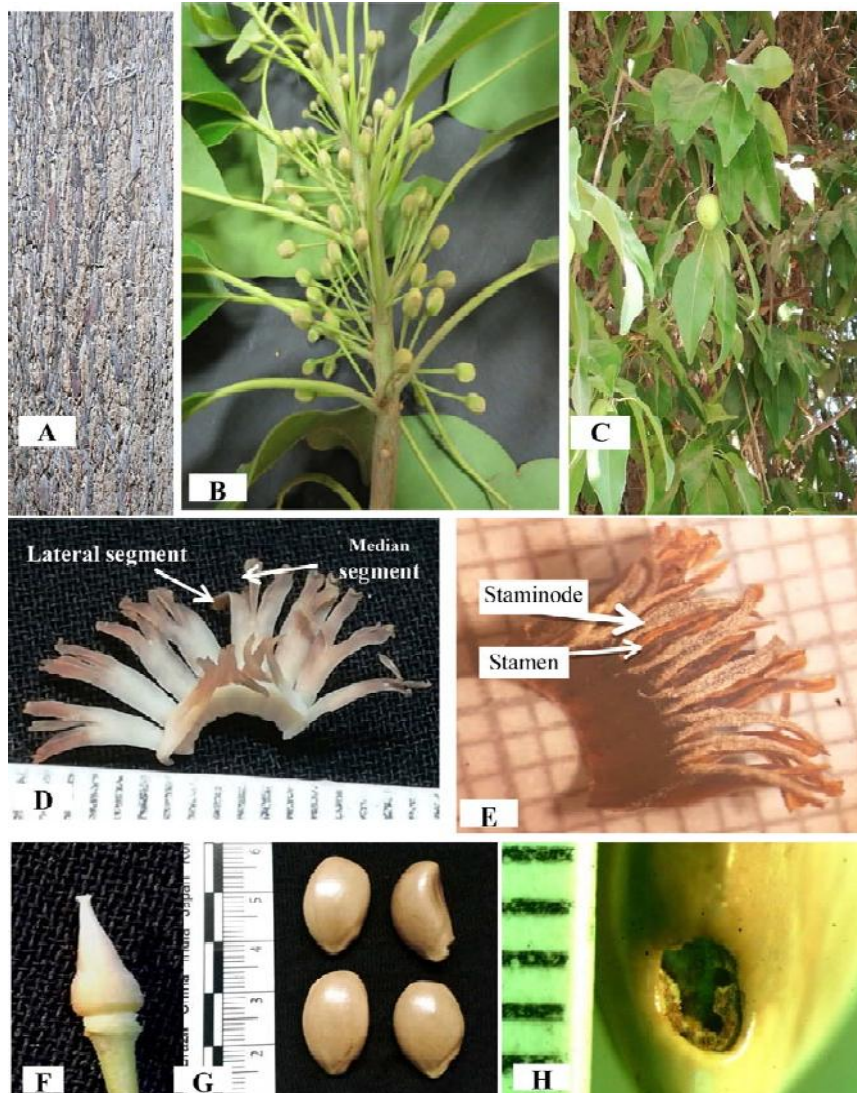


Fig. 3 : Field photographs of *Mimusops laurifolia* (Forssk.) Friis.

A: Trunk; B: Twig with leaves and inflorescence (flower buds); C: Twig with leaves, and fruit; D: Corolla opened with 3 corolla-lobes, showing median and 2-lateral segments; E: Corolla longitudinally sectioned and opened showing stamens and staminodes, ventral view; F: Gynoecium; G: Seed, lateral view; H: Seed with seed-scar, ventral view [Zoological Garden; *Abdelmohsen* s.n. (CAI)].

**Global distribution:** This species is restricted to the mountains around the Red Sea and the Gulf of Aden. It occurs in Northeast Tropical Africa (Djibouti, Ethiopia, Eritrea, and Somalia) and Arabian Peninsula (Saudi Arabia, N Yemen) in Temperate Asia. Records from Sudan (Northeast Tropical Africa), Uganda (East Tropical Africa), and Ancient Egypt are presumably due to introduction (Friis, 1981, 2003).

**Taxonomic notes:** In Orman (Giza) and Plant Island (Aswan), this species was regarded by earlier investigators as *Mimusops elengi* L. However, both

species can be discriminated by floral and fruit characters. *Mimusops laurifolia* has blunt or rounded flower buds; lanceolate to oblong-lanceolate calyx-lobes with obtuse apex; shorter (6–7 mm long) flowers; corolla-tube longer than corolla-lobes; irregularly incised (divided) lateral segments; stamens with short (c. 0.5 mm long) filaments; short (c. 2.5 mm long) staminodes with acute apex; and green fruit with 1–4-seeded. In contrast, *Mimusops elengi* possesses acute flower buds; narrowly ovate calyx-lobes with acuminate apex; longer (8–12 mm long) flowers; corolla-tube shorter than corolla-lobes; entire

(undivided) lateral segments; stamens with longer filaments (1–3 mm long); longer (4–6 mm long) staminodes with toothed apex; and orange-red fruit with 1(–2)–seeded.

**Uses:** Fruit is edible; planted as shade or ornamental tree.

**4. *Mimusops zeyheri*** Sond., *Linnaea* 23: 74 (1850); Engl., *Monogr. Afr. Pflanzenfam.* 8:73 (1904). “*Common red milkwood*”

**Description:** Small-to medium-sized, evergreen tree, up to 20 m high, with milky latex; crown much branched, spreading, and rounded; bark brown and reticulately fissured; bole straight, not buttressed.

**Young vegetative parts** densely adpressed-pubescent, with ferruginous indumentum, soon glabrescent.

**Leaves** coriaceous or thinly coriaceous, not clustered, broadest part at the middle, above or below and petiolated; blade elliptic to oblong-elliptic or obovate, sometimes lanceolate, (4–) 6–11 cm long, 2.0–5.5 cm wide, leaf blade 2–3 times as long as broad; apex acute to obtuse or commonly bluntly apiculate, rarely rounded or emarginate; base cuneate or acute; margin yellow, thickened, entire; upper surface dark green, glossy, with ferruginous hairs, later glabrescent, and with conspicuous vein reticulation; lower surface pale green, mat, with raised vein reticulation, more tardily glabrescent than above, with persistent ferruginous hairs on and along the midrib, indumentum sometimes becoming greyish; midrib prominent on both surfaces, lateral veins 10–15 pairs; petiole canaliculate, dilated at the base, 1.0–3.5 cm long, shorter than the leaf blade (leaf blade = 3–5 × petiole), adpressed-pubescent, with ferruginous hairs. **Inflorescence** 1–3 (–5, not in ours)–flowered; flowers 10–15 mm in diam.; flower buds 5–7 × 3–5 mm, 1.5–2.0 times as long as broad, acute or subacute, pedicelled; pedicel erect to ascending or commonly recurved, slender, sulcate when dry, 10–17 mm long, slightly accrescent in fruit, subequal or commonly shorter than the petiole (petiole = 1–3 × pedicel), adpressed-pubescent, with ferruginous indumentum. **Calyx** 7–10 mm long, not accrescent in fruit; calyx-tube c.1.0 mm long; outer calyx-lobes lanceolate or ovate-lanceolate, 8.0–9.0×3.0–4.0 mm, with paler margin, acute, dorsally ±3-nerved below, densely adpressed-pubescent, with ferruginous hairs outside and inside (less inside); inner calyx-lobes shorter, narrower, and paler, 6–7×2–3 mm,

acute, dorsally with brown median groove, and with greyish-white hairs. **Corolla** white, 6–9 mm long, shorter to longer than calyx; corolla-tube 1–2 mm long; median segments elliptic to oblong-elliptic or lanceolate with a narrow basal attachment, 5–7 × 1 mm, acute or obtuse at the ± mucronulate apex, sometimes serrate-denticulate; lateral segments lanceolate, 4–6 mm long, entire (undivided), shorter to longer than the median segments, pluri-nerved, apex acute to obtuse or serrate-denticulate at the mucronulate apex. **Stamens** 4–5 mm long; filaments subulate, 1.5–2.5 mm long, glabrous; anthers lanceolate, 2.5–3.5×1.0–1.5 mm, with dark brown apiculate apex (apicula 0.3–0.5 mm long), hairy on and along the connective tissue; staminodes elongated deltoid to deltoid-lanceolate or lanceolate-subulate, either acute and shorter than stamens and corolla lobes or long acuminate-caudate and subequal or slightly longer than stamens and as long as the corolla lobes, densely pilose throughout outside except the paler tip. **Gynoecium** 7–11 mm long; ovary ovoid to globose, 2–3 × 1–2 mm, densely pilose; style yellowish, slender, 5–9 mm long, included or slightly exerted, glabrous; stigma reddish-brown, 0.3–0.5 mm in diam., hairy. Fruiting calyx clasped to the fruit or spreading; **fruit** green, turning into brittle yellow or orange when ripe, with orange pulp, ellipsoid to ovoid, 2.0–4.0 × 1.5–2.5 cm, 1.5–2 times as long as broad, with acute to obtuse or with shortly rostrate/beaked apex, usually crowned by the persistent style at least when young, glabrous, 1-seeded; **seed** obovoid, c. 18 × 9–10 × 6–7 mm, glabrous; testa brown, shiny; scar basal, oblate (horizontal), 1.5 × 1.7–2 mm. (Fig. 5).

**Global distribution:** It is widely distributed in South Tropical Africa (Angola, Malawi, Zambia, Mozambique, and Zimbabwe) northwards to Tanzania in East Tropical Africa, and southwards to Southern Africa (Botswana, Natal, and Transvaal).

In Egypt, *M. zeyheri* tends in the direction of var. *laurifolia*.

var. *laurifolia* Engler, *Monogr. Afr. Pflanzenfam.* 8: 73, tab. 27/C (1904).

Type: South Tropical Africa: Malawi, 1895, *Buchanan J.* 304, BM000925409, isotype, (BM, image!), (Fig. 5).

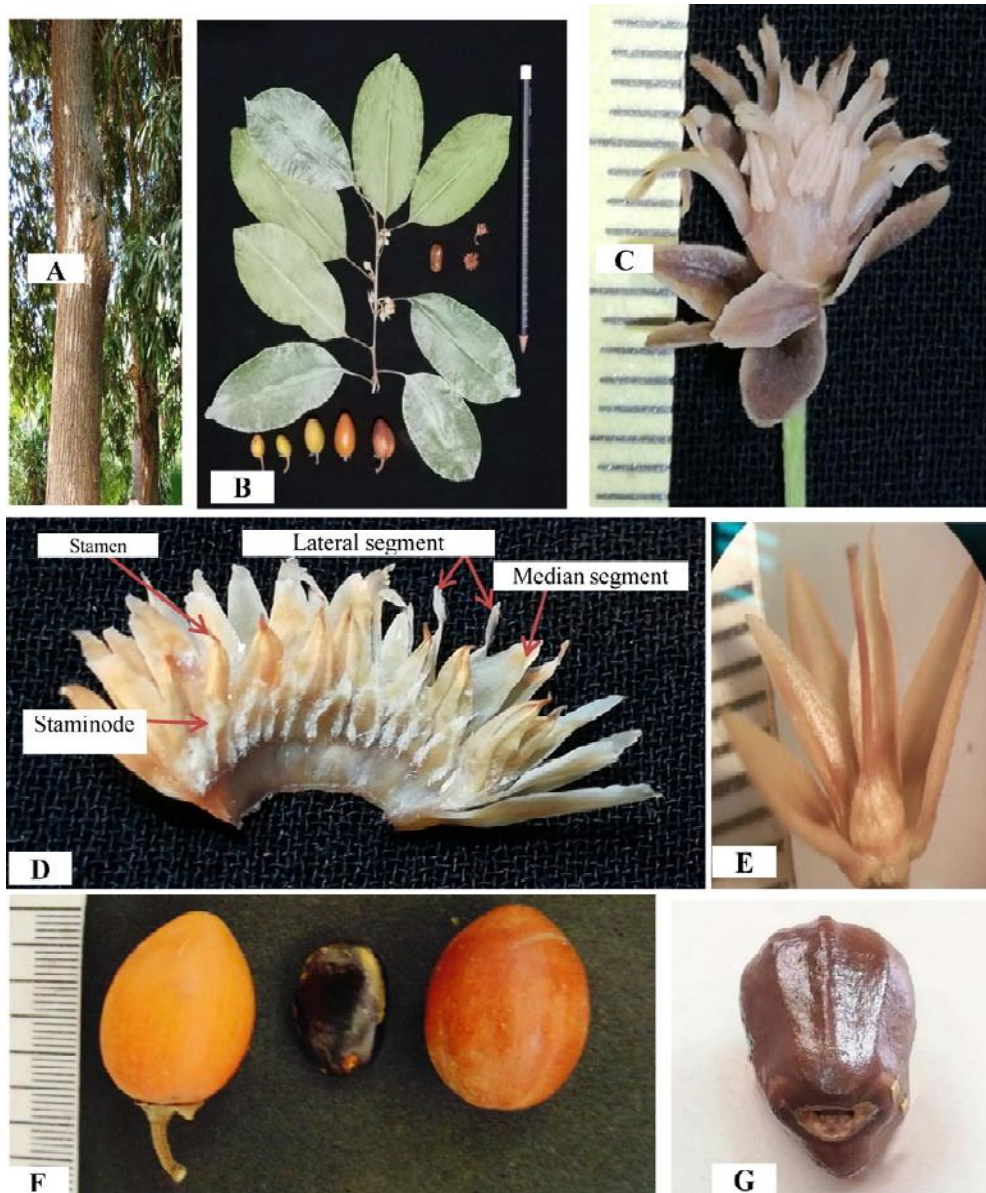


Fig. 4 : Field photographs of *Mimusops zeyheri* Sond. var. *laurifolia* Engl.

A: Trunk; B: Twig with leaves, inflorescence and fruits (below); C: Flower, lateral view; D: Corolla longitudinally sectioned and opened, ventral view; E: Corolla and one sepal removed, showing gynoecium; F: Fruit and seed, lateral view; G: Seed with seed-scar, ventral view [Zohriya Garden; *Abdelmohsen* s.n. (CAI)].

Petiole 2.0-3.5 cm long, 2-3 times as long as the pedicel; corolla-segments not serrate-denticulate at apex; staminodes deltoid lanceolate, 2-3 mm long, acute, shorter than stamens and corolla lobes (nearly half the corolla-lobes).

**Taxonomic note:** The specimens were misidentified as *M. obovata* Sond. since both have entire lateral segments. However, *Mimusops zeyheri* var. *laurifolia* Engl. has longer (2.0-3.5 cm) petioles [vs. shorter, less

than 1 cm long]; flowering pedicels are shorter than the petioles [vs. longer than the petioles]; both median and lateral segments are different in shape and size [vs. subequal in shape and size]; and staminodes are shorter than stamens and corolla-lobes [vs. as long as stamens and corolla-lobes].

**Phenology:** Flowering season April, June-July, October; Fruiting season June, September-October.

**Use:** As ornamental tree.

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